STEEL

BestPractices
Management Case Study

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OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY

Ongoing Control System Modernization Project at a Steel Plant Improves Operations

Benefits

- Improves process control
- Saves energy
- Reduces maintenance
- Reduces emission of pollutants

Applications

An automated centralized control system tying together various functions in a plant can improve efficiency and productivity. Any manufacturing facility with inter-related systems could potentially benefit from the additional level of process control and integration that modern, computerized central control systems can provide.

Summary

Weirton Steel Corporation is the eighth largest steel producer in the U.S. and its main manufacturing facility is located in Weirton, West Virginia. In 1998 Weirton Steel successfully implemented a project at its Weirton plant in which it modernized the control systems on its utilities and built a control center in a central location from which those utilities could be monitored. The utilities included are the steam system, a Basic Oxygen Plant (BOP) and an electrical generation system. The modernization of the controls for each of the utilities, as well as the central monitoring facility, resulted in substantial energy and cost savings, as well as a more efficient and improved production capability. Recently Weirton has begun planning another project in collaboration with two engineering firms that will synchronize the control systems together in order to further control system dynamics and improve the efficiency of the utilities. Once this project is completed, Weirton Steel will be able to further reduce its energy consumption and improve its utilities' systems operation, leading to better profitability.

Weirton Plant

System Background

Weirton's first control system modernization project replaced antiquated control equipment with a group of modern, state-of-the-art, computer-controlled systems monitored from a central control center. The new controls have allowed the plant to save energy and utilize fewer generators, boilers and blowers for two main reasons - their ability to modulate the various processes more rapidly and to capture and harness waste heat and steam to generate steam and power. The production processes at a steel plant are cyclical and dynamic, which create a situation of constantly shifting energy demand patterns. The speed and sophistication of the new controls allows the utility systems to be more responsive to changes in these energy demand patterns leading to more efficient (less wasteful) use of the fuels needed to power the utility systems. In addition, the production processes in the blast furnaces and the basic oxygen plants give off large quantities of blast furnace gas and waste steam. If these by-product energy sources are not used immediately, they are released into the atmosphere, leading to valuable energy loss and pollution. The new controls that were installed are able to capture most of this steam and heat and use it to generate electricity and additional steam from heat instead of relying on the use of purchased fuel. These improvements alone have resulted in a 30% reduction in blast furnace gas and waste steam release and a 50% reduction in the amount of purchased fuels needed, leading to $12 million in annual fuel savings.

Control Center

Project Overview

The current project seeks to build on the modernization of the controls by creating an additional, next-higher level of automation that will leverage the existing system's statistical, technical reporting and control capabilities as well as link the systems together to optimize the production process. The project will be implemented by a project team made up of Asea Brown Boveri – Combustion Engineering (ABB-CE), Fisher/Rosemount and Weirton Steel. ABB–CE is a division of Asea Brown Boveri USA that specialize in building advanced power plant control complexes. Fisher/Rosemount, a division of Emerson Electric Company, is a leader in the field of process control instrumentation and architecture. Both firms have a long history of collaboration with Weirton Steel. ABB-CE will conduct a technical evaluation of the operating practices, production rates, equipment capacities and system control strategies. ABB-CE will then combine the information from the evaluation with process logic from diagnostics that will be installed by ABB-CE and Fisher/Rosemount in collaboration with Weirton Steel to create the new system. In addition, the new systems will connect the controls on each of the utilities (steam system, electrical generating plant and basic oxygen plant) together. This will allow for real time communication data flow between 22 different operating units, which will enable them to react together in controlling the dynamic production process. Once completed, the new system will be able to continuously evaluate every level of energy production, *anticipate* dynamic energy fluctuations and rapidly control process upsets. This capability will enable the plant to utilize more by-product energy for process or electric power generation.

Weirton Plant

Project Significance

The controls optimization project is significant on two levels. On one level it represents a forward-looking application of technology by management in a way that is most advantageous to the firm and that has the possibility of maximizing its ability to reduce energy without degrading system performance or production levels. At Weirton Steel the implementation of the modern, computerized control systems on its utility systems could have been considered "good enough" since it led to substantial energy savings and improved production. Instead, management decided to evaluate ways of capturing *all* of the excess by-product energy possible, thereby further reducing energy costs and environmental pollutants.

On a second level, it stands as an example of successful teamwork by various entities in accomplishing an objective – in this case the optimization of a steel plant's control system. In any system improvement project it is essential to keep all of the team members focused on the objective. In the case of the Weirton plant, the stakeholders are working in concert to implement the features of the project while performing the portions of the project that they can best perform. Therefore, ABB-CE is developing the process logic and performing the technical evaluation of the control systems while Fisher/Rosemount is developing the hardware and software required by the new system. However, they are both working with Weirton Steel's personnel in implementing the diagnostics from which the process logic will be derived. The successful use of information technology to synchronize complex unit operations in order to control dynamic system changes requires different forms of technical expertise and therefore, a high degree of collaboration. The level of teamwork being displayed in Weirton Steel's controls optimization project is exemplary of how such a level of teamwork can lead to the successful implementation of this type of project.

Industry of the Future—Steel

Through OIT's Industries of the Future initiative, the Steel Association, on behalf of the steel industry, has partnered with the U.S. Department of Energy (DOE) to spur technological innovations that will reduce energy consumption, pollution, and production costs. In March 1996, the industry outlined its vision for maintaining and building its competitive position in the world market in the document, The Re-emergent Steel Industry: Industry/Government Partnerships for the Future.

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BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices focuses on plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small and medium-size manufacturers.

Project Partners

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